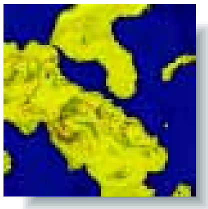
HAZARD MITIGATION AT WORK:
TWO GEORGIA COMMUNITIES

FEMA

FEDERAL EMERGENCY MANAGEMENT AGENCY



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EXECUTIVE SUMMARY

Each year natural disasters cause millions of dollars in damages. But the toll doesn't end there. The human misery that inevitably follows in the wake of disasters can't be measured in dollars. As footage of disasters is broadcast to the homes of millions, a question on people's minds is: can't something be done about this?

The answer is yes. Something *is* being done. It's called hazard mitigation, and FEMA is leading the way to help communities use hazard mitigation to make themselves disaster-resistant. This report tells the story of how FEMA helped two Georgia communities reduce the impact of repeated flooding.

We begin with a discussion of FEMA's *Hazard Mitigation Grant Program* (HMGP). This program, which is a part of the Robert T. Stafford Disaster Relief and Emergency Assistance Act ("The Stafford Act"), assists states and local communities in implementing hazard mitigation measures after major disasters.

The next section provides an overview of benefit-cost analysis, FEMA's mechanism for evaluating mitigation projects. Benefit-cost analysis, which is required by the Stafford Act, determines whether hazard mitigation projects will be cost-effective. In this context, cost-effective means: the cost of funding the project is less than the cost of damages in future disasters *without* the measure.

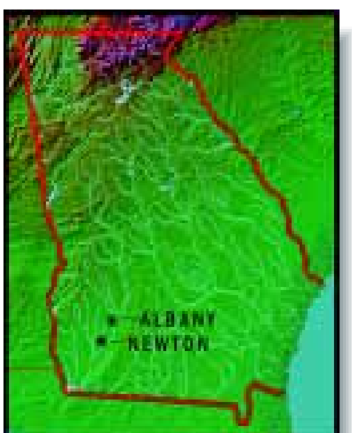
We then explore how the cities of Newton and Albany, Georgia endured flooding over the past several years. Both have a history of flooding, and both suffered severe damage in the floods caused by Tropical Storm Alberto in 1994. This section reviews the FEMA-funded hazard mitigation projects implemented in each community after the floods: removing hundreds of flood-prone properties.

> "THE INTEGRATION OF MITIGATION INTO LONG-TERM RECOVERY ENSURES THAT THE COMMUNITY WILL BE A SAFER, MORE ECONOMICALLY-VIABLE, DISASTER-RESISTANT PLACE AFTER THE DISASTER THAN IT WAS BEFORE."
>
> — PRESIDENT'S LONG-TERM RECOVERY ACTION PLAN GEORGIA, MARCH 1998

Next, we explain how the benefit-cost analysis was conducted for each project and what it concluded. As it turned out, the projects prevented flood damages in each community only a few years after they were implemented.

In March 1998, heavy rainstorms caused more flooding in southwest Georgia. While generally not as severe as in 1994, both Albany and Newton again suffered extensive flooding. But because the project removed the structures from flood-prone areas after the 1994 floods, millions of dollars in damages were avoided. The results underscore the need for hazard-prone communities to get serious about mitigation.

The following pages tell the story of two communities that—with help from FEMA and the state of Georgia—have already saved millions in disaster-related damages.



The Georgia river system.

FOR AN IN-DEPTH REVIEW OF THE ANALYSIS PRESENTED HERE, SEE THE APPENDIX TO THIS REPORT.

HAZARD MITIGATION

Community Selection. . .
at a Glance

Newton and Albany, Georgia are good examples of what communities can do about repetitive flooding. They were selected for this report because:

- each has a history of flooding, most recently in 1998 and 1994
- each received funding from FEMA for mitigation projects that were identified after the 1994 floods and completed before the March 1998 floods
- the measures were put to the test in a real disaster not long after the measures were carried out

Disasters are inevitable events that we can't predict or control. But how we reduce, or mitigate, their effects is something that we *can* control. And that's where FEMA's Hazard Mitigation Grant Program (HMGP) comes in.

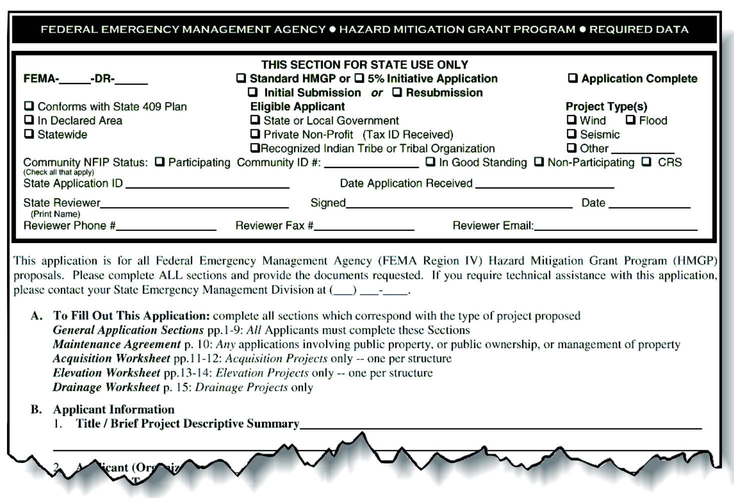
What is Hazard Mitigation?

In lay terms, hazard mitigation is simply an investment made today that will reduce the toll from disasters tomorrow.

President Clinton and FEMA Director James L. Witt have made it a priority to end the cycle of rebuilding from disasters, where states and communities are constantly forced to pick up the pieces. That's why FEMA funds hazard mitigation projects through the HMGP.

> The benefits that accrue from a hazard mitigation measure are the avoided damages. The damages avoided are defined as the difference between expected future damages with and without. . .the hazard mitigation measure.
>
> — Hazard Mitigation Grant Program Interim Guidance

The program is targeted at communities that are especially prone to natural disasters. Local governments work with the state to identify the best mitigation project for their area. Typical flood projects include removing or elevating repetitively flooded structures, or retrofitting public facilities and improving stormwater drainage.



FEDERAL EMERGENCY MANAGEMENT AGENCY • HAZARD MITIGATION GRANT PROGRAM • REQUIRED DATA

THIS SECTION FOR STATE USE ONLY

FEMA-_____-DR-_____ ❑ **Standard HMGP or** ❑ **5% Initiative Application** ❑ **Application Complete**
❑ **Initial Submission** ***or*** ❑ **Resubmission**

❑ Conforms with State 409 Plan
❑ In Declared Area
❑ Statewide

Eligible Applicant
❑ State or Local Government
❑ Private Non-Profit (Tax ID Received)
❑ Recognized Indian Tribe or Tribal Organization

Project Type(s)
❑ Wind ❑ Flood
❑ Seismic
❑ Other __________

Community NFIP Status: ❑ Participating Community ID #: __________ ❑ In Good Standing ❑ Non-Participating ❑ CRS
(Check all that apply)
State Application ID __________ Date Application Received __________
State Reviewer__________ Signed__________ Date __________
(Print Name)
Reviewer Phone #__________ Reviewer Fax #__________ Reviewer Email:__________

This application is for all Federal Emergency Management Agency (FEMA Region IV) Hazard Mitigation Grant Program (HMGP) proposals. Please complete ALL sections and provide the documents requested. If you require technical assistance with this application, please contact your State Emergency Management Division at (___) ___-____.

A. **To Fill Out This Application:** complete all sections which correspond with the type of project proposed
General Application Sections pp.1-9: *All* Applicants must complete these Sections
Maintenance Agreement p. 10: *Any* applications involving public property, or public ownership, or management of property
Acquisition Worksheet pp.11-12: *Acquisition Projects* only -- one per structure
Elevation Worksheet pp.13-14: *Elevation Projects* only -- one per structure
Drainage Worksheet p. 15: *Drainage Projects* only

B. **Applicant Information**
1. **Title / Brief Project Descriptive Summary**__________

Detail from FEMA's Region IV Hazard Mitigation Grant Application.

Hazard Mitigation Grants

In 1988, the HMGP was incorporated into the Stafford Act, the law that governs FEMA's disaster recovery activities. Federal funding under the HMGP is based on 15% of disaster relief funds spent on Public and Individual Assistance programs for each disaster.

Project applications are then submitted to FEMA for review, where they must meet several eligibility criteria before they can be approved. Depending on the project type, eligibility review can include: environmental compliance, floodplain management regulations, benefit-cost analysis, executive orders, and engineering feasibility.

Flood Mitigation Projects

There is a wide variety of flood mitigation projects. And while many projects, such as elevating buildings and upgrading stormwater drainage systems, may be cost-effective solutions in small- to medium-sized floods, they don't eliminate the flood threat completely. In the largest floods, even the best preventive mitigation measures may fail.

The only 100% effective mitigation project is known as an *acquisition* project. An acquisition project (or "buyout") is a federally-funded measure to purchase and remove buildings from the floodplain. As a result, the risk of future flooding to the building is zero. But acquisitions are expensive and may not be the best approach for structures with low-to-moderate flood risk.

Benefit-Cost Analysis. . . at a Glance

- Estimates future benefits over life of project
- Benefits are damages that would result *without the measure*—and are avoided *with* it
- Helps communities choose best project

A Note About Benefit-Cost Analysis

Before 1993, there were no consistent standards for evaluating hazard mitigation projects. By setting a reliable benchmark—*cost-effectiveness*—we can now determine whether a project is worth investing in now for the benefits of avoiding disaster-related damages later.

In 1988, the Hazard Mitigation Grant Program was incorporated into the Stafford Act, the law that governs FEMA's disaster recovery activities.

Software that Analyzes Mitigation Benefits & Costs

To standardize the analysis and make it easier to complete, FEMA has developed software to analyze mitigation projects for several different hazards. For Newton and Albany, FEMA used the benefit-cost analysis application for *riverine flooding*. The benefits of avoided damages and losses are broken down into the following categories:

- building/infrastructure
- building contents
- displacement costs
- loss of rental income
- loss of business income
- emergency services

Analysts use the software to compare the long-term benefits of a project to its cost.

The next section examines in detail how benefit-cost analysis actually works.

BENEFIT-COST ANALYSIS

Nobody can predict exactly when the next disaster will happen—next week, next year, or next century. But through a combination of flood hazard data, engineering expertise, and historical flood observations, we can accurately estimate the probability and severity of future floods.

Why Benefit-Cost Analysis?

Office of Management and Budget (OMB) regulations require all hazard mitigation projects to be cost-effective before they can be approved for funding. What does this mean? In the language of hazard mitigation, it means benefit-cost analysis must be used to determine whether a project's benefits—avoided damages in future disasters—outweigh its up-front costs. Put simply, if a benefit-cost analysis concludes that a project that costs $1 million today will save $2 million in potential flood damages over the life of the project, then it's cost-effective.

OMB Requirements. . . at a Glance

The Office of Management and Budget (OMB) provides specific guidance for doing a benefit-cost analysis. OMB recommends that analyses include comprehensive estimates of expected benefits and costs to society based on established definitions and practices.

Nuts & Bolts

The end result of a benefit-cost analysis is called a *benefit-cost ratio*. The benefit-cost ratio is determined by dividing estimated project benefits by total project costs. In the above example, the ratio would be 2.0.

Benefit-cost analysis is based on calculations of hazard (the frequency and severity of a disaster), avoided future damages, and risk (the threat of damage to buildings and infrastructure). Similar concepts are used for all disasters—from hurricanes and floods to earthquakes.

"We made the right decision [to have our home acquired after the '94 flood]. The March '98 flood waters rose above ground level to a height of nine feet. We still had another seven feet before the waters would have reached our first floor."

— Jim Barker
Newton Resident

Flood Hazard Data

For flood mitigation projects, FEMA's software uses flood hazard data to create a picture of the probability and severity of flooding at the project site. Flood hazard data can be taken from FEMA's Flood Insurance Studies, USGS surveys, and/or historical observations.

Flood hazard data include flood frequencies (10-year, 50-year, 100-year, etc.), discharges (amount of river or stream water flow), and flood levels. The software combines flood frequency and elevations to calculate likely flooding in one-foot increments above a building's first floor.

The frequency (probability) and severity (depth) of flooding depend on the relationship between a structure's first floor elevation and the flood levels at the site.

Elevation of Structures

Accurate data on each building's elevation are critical for analysis. When elevations are combined with flood hazard data, the

Table 1. Benefit-Cost Analysis Basics

Flood Hazard Data ❶		Estimating Damages ❷		Flood Risk* ❸
Flood frequency Flood discharge Flood levels + First floor elevations **Flood probability**	x	Building damages Contents losses + Displacement costs **Dollar losses/flood event**	=	**Annualized future flood losses**

*Annual average flood losses in dollars.

software determines how often a structure will flood and how deep the water will be in different flood events. It's important to understand that the lower a structure is in the floodplain, the more frequent and severe the flooding will be at the site. It makes sense, then, that the best mitigation projects will prevent the most future damages where the risk of flooding is highest.

Estimating Damages

The next step in the analysis is to estimate the costs of damages in future floods to buildings and contents, displacement of families and individuals, and disruption of the local economy. Generally, this information is obtained from local sources. For example, local officials often supply information on building size, construction type, and other data to help develop damage estimates. The software also includes several built-in values for this information based on insurance claims submitted to the Federal Insurance Administration.

Key Concepts

Mitigation benefits accrue over the life of the project. Acquisition projects, like those in Newton and Albany, are considered a permanent solution to the flood problem. Damages after an acquisition project are always zero: the structures are no longer in the floodplain, and the analysis estimates damages if structures were to remain.

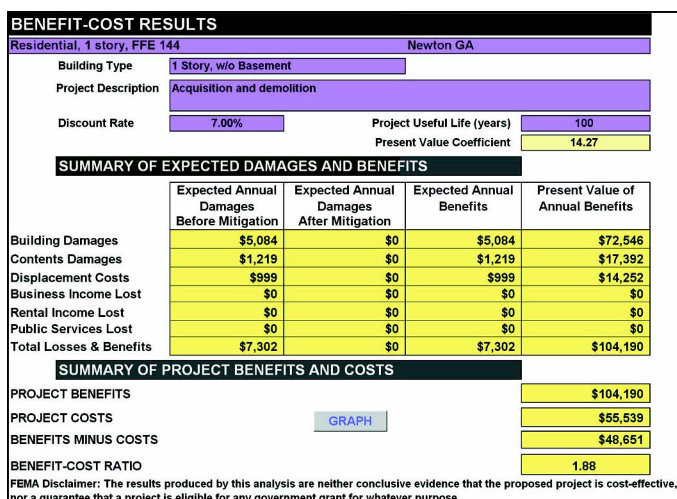
Avoided damages, then, are the benefits of the mitigation project. (For analysis purposes, the projects were assigned a useful life of 100 years.) Federal regulations require that acquired properties be maintained as open space for wetlands or for recreational purposes.

For structures acquired in Newton and Albany, the benefits of avoided damages to buildings and contents, as well as displacement costs, were estimated. For commercial structures, the benefits of avoiding lost business income were also estimated. The graphic below shows the results page from FEMA's benefit-cost analysis software summarizing a project's benefits and costs.

The next section takes a look at Newton and Albany, and how they responded to the devastating floods caused by Tropical Storm Alberto in 1994.

Elevation & Flooding. . . an Example

The lower a house sits in the floodplain, the higher the flood risk and the more frequent and severe flooding will be. For example, a house in a valley whose first floor is 176 feet above sea level might flood about once every 10 years. But a nearby house on a hill with a first floor elevation of 190 feet might flood once every 500 years. So the acquisition projects that offer the most benefits acquire buildings that are deepest in the floodplain.



BENEFIT-COST RESULTS

Residential, 1 story, FFE 144 — Newton GA

Building Type: 1 Story, w/o Basement

Project Description: Acquisition and demolition

Discount Rate: 7.00%

Project Useful Life (years): 100

Present Value Coefficient: 14.27

SUMMARY OF EXPECTED DAMAGES AND BENEFITS

	Expected Annual Damages Before Mitigation	Expected Annual Damages After Mitigation	Expected Annual Benefits	Present Value of Annual Benefits
Building Damages	$5,084	$0	$5,084	$72,546
Contents Damages	$1,219	$0	$1,219	$17,392
Displacement Costs	$999	$0	$999	$14,252
Business Income Lost	$0	$0	$0	$0
Rental Income Lost	$0	$0	$0	$0
Public Services Lost	$0	$0	$0	$0
Total Losses & Benefits	$7,302	$0	$7,302	$104,190

SUMMARY OF PROJECT BENEFITS AND COSTS

PROJECT BENEFITS	$104,190
PROJECT COSTS	$55,539
BENEFITS MINUS COSTS	$48,651
BENEFIT-COST RATIO	1.88

GRAPH

FEMA Disclaimer: The results produced by this analysis are neither conclusive evidence that the proposed project is cost-effective, nor a guarantee that a project is eligible for any government grant for whatever purpose.

"Results" page from the Benefit-Cost Analysis software.

THE 1994 FLOODS

Newton Flooding. . . at a Glance

- Downtown area under 12 feet of water
- Flood depths up to 20 feet
- 150 homes and businesses flooded
- Several historic structures damaged
- Total damages: $4.5 million

Albany Flooding. . . at a Glance

- Flint River peak: 42 feet—22 feet above flood stage
- Tens of thousands left homeless
- 6,500 homes damaged or destroyed
- Hundreds of businesses damaged or destroyed

In 1994, Tropical Storm Alberto devastated central and southwestern Georgia. The river communities of Newton and Albany were among the hardest hit by floods from the storm. This section focuses on these two cities, the damages they suffered, and what they did to reduce their vulnerability to future floods.

City of Newton

Located in Baker County, Newton is a small rural town with a population of less than one thousand. The town lies about 20 miles southwest of Albany and is located next to the Flint River. Newton is governed by a mayor and a council, and is the county seat for Baker County.

Baker County was founded in 1825 when it separated from adjacent Early County. Local attractions include the Baker County Courthouse and the Pine Bloom and Tarver Plantations—all of which are listed on the National Register of Historic Places.

City of Albany

Founded in 1836 by a group of businessmen, Albany became a center of agricultural commerce in southwest Georgia. The city is located on the Flint River, and grew by serving as a base for shipping to the Gulf of Mexico. As rail transportation and industrialization were introduced in the late 19th and early 20th centuries, the city's economy expanded and diversified.

Today, with a population of nearly 100,000, Albany is Georgia's sixth largest city, and is home to Albany State University. A thriving major hub for the state's industry, business, and culture, Albany was voted one of the best places to live by *Money Magazine* in 1998.

"For most [residents] it has been difficult. In the '94 flood some people lost everything they had, while others were able to get out their personal keepsakes."

— Robert Hughes
Newton Chief of Police

Tropical Storm Alberto

In early July of 1994, Tropical Storm Alberto ravaged southern Georgia, leaving a trail of flooding and devastation that is considered the worst natural disaster in the state's recorded history. Alberto, which meandered over the state for several days before dying out, dumped up to 28 inches of water in some areas. One-third of Georgia's counties were declared federal disaster areas.

Source: Microsoft/USGS Terraserver

Satellite view of Albany and the Flint River.

Source: Microsoft/USGS Terraserver

Satellite view of Newton and the Flint River.

TROPICAL STORM ALBERTO. . . AT A GLANCE

- Georgia's worst natural disaster
- Severe flooding; up to 28 inches of rain
- $750 million in damages
- 33 people killed

FEMA was quick to respond by providing temporary housing, public assistance, and individual and family grants to victims of the floods. Damages totaled over $750 million, and 33 people were killed.

FLOODING IN NEWTON

Some of the worst devastation in the flood occurred in Newton. The downtown area was under 12 feet of water for several days, and flood depths in some areas were as high as 20 feet. Over 150 homes and businesses were flooded. According to some local estimates, damages came to $4.5 million—that's $5,000 for every man, woman, and child.

HAZARD MITIGATION MEASURES

In the Newton mitigation project, FEMA funded the acquisition and demolition of 20 residential and 19 commercial structures. All but one business moved out of the floodplain. The result? Many people were spared from the flooding that hit the town in 1998. (See page 13.) Local officials indicate that eventually even more Newton residents are likely to move out of the floodplain.

Source: USGS

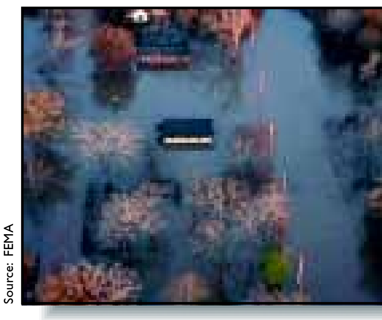
Flint River after Tropical Storm Alberto.

FLOODING IN ALBANY

As one of the larger cities in the path of Alberto, Albany was also one of the hardest hit. Within a few days of the storm's arrival, the water level of the Flint River rose from 8 feet to 42 feet—22 feet above flood stage. Flash flooding overwhelmed the city's drainage system, and nearly one-third of the city's residents were left homeless. Over 6,500 homes and hundreds of businesses were damaged or destroyed. Several schools were also destroyed.

HAZARD MITIGATION MEASURES

In Albany, over 700 structures were approved for acquisition with funding from various government sources. Some homeowners who originally wanted to have their properties acquired eventually decided not to join the program. Other structures, including the local schools,



Source: FEMA

Aerial view of flooded homes in Albany.

were rebuilt on higher ground. To date, a total of 146 structures have been "bought out" by FEMA. Data for 105 of these structures were available for purposes of this analysis. (Additional structures are expected to be considered for acquisition by FEMA.)

According to one local official, the buyout not only prevented flooding of hundreds of homes, but also permitted city workers to concentrate on preparing for flood waters during the March 1998 storm instead of evacuating people from low-lying areas.

In the next two sections we'll examine the benefit-cost analyses of these mitigation measures.

BENEFIT-COST ANALYSIS: NEWTON

After the 1994 floods, FEMA conducted a benefit-cost analysis for many flood-prone structures in Newton. The analysis compared the costs of acquiring and removing at-risk structures with estimated damages from future floods if the buildings were not acquired.

FEMA's goal in this report was to use the best data available in mid-1998 for the structures that were actually acquired. Because several property owners eventually decided not to be included in the buyout, the data used in this report are similar, but not identical to, data used in previous analyses.

NEWTON ANALYSIS. . . AT A GLANCE

- PROJECT COST: $754,464
- BENEFITS: $1,645,426
- BENEFIT-COST RATIO: 2.18

FLOOD HAZARD DATA

The first step in doing a benefit-cost analysis involves gathering flood hazard data. Typically, information on flood hazards for a community is taken from one of the thousands of Flood Insurance Studies (FIS) that FEMA has conducted throughout the country. In Newton, however, no FIS data were available.

But FIS reports aren't the only source of flood hazard data. The United States Geological Survey also gathers flood hazard information. As shown in Table 2, USGS data were used to determine flood levels in Newton.

Table 2. Flood Hazard Data – Newton

Frequency (years)	Discharge (cfs)	Elevation* (feet above sea level)
10	71,160	141.3
50	104,040	148.5
100	118,920	151.3
500	156,000	157.3

*Flood elevation data from USGS.

> "WITH THE HELP OF FEMA AND GEMA WE WERE ABLE TO GET OUT [OF THE AREA FLOODED IN 1994]. OUR NEW HOUSE WAS NOT AFFECTED BY THE '98 FLOODS."
>
> — OXFORD ROUSE
> NEWTON RESIDENT

FLOOD DAMAGES & LOSSES BEFORE MITIGATION

The next step in the analysis is to gather the data needed to estimate damages to buildings and their contents, displacement costs, and business income losses in future floods. This information includes the number, size, and replacement value of buildings, the value of their contents, estimated costs for temporary living quarters for displaced residents, and lost business income. The values and sources of this information are listed in Table 3 below.

FEMA's software combines this information with flood hazard data and building elevations. The result is a clear picture of how damages increase as flood depths increase.

Table 3. Data Sources – Newton Analysis

The data category...	...and its value...	...came from
Building Replacement Value (BRV)	$43	Local officials[1]
Demolition %	FEMA formula	FEMA formula[2]
Building Size	Building type	City data
Contents Value	30% of BRV or $20,000	FEMA estimate[3]
Displacement Costs (Rent)	$0.50 (sf/month)	Local data
Displacement Costs (Other)	$0.25 (sf/month)	FEMA estimate
Displacement Costs	$200 (one time)	FEMA estimate
Net Business Income	$20 (sf/year)	Typical value[4]

[1]From local officials, validated by comparison with Means Typical Cost estimates.
[2]FEMA used 50% of BRV or Fair Market Value, whichever was lower. (See Appendix for detailed explanation.)
[3]Whichever is lower.
[4]Composite of retail trade, personal, and repair services.

Analysis and Conclusions

Once all damage data are gathered and entered into the benefit-cost analysis software, a summary is generated that shows how severe future flood losses would be if the structures were to remain. That is, *if the project to remove the structures were not implemented.*

It bears repeating that the mitigation project—acquisition and removal of structures—completely eliminates the potential for future losses. The *benefits* of the mitigation project are the damages avoided, as listed in Table 4 below. These results from FEMA's benefit-cost analysis for Newton show the relationship among all key categories that are used to determine project cost-effectiveness.

The table provides a detailed breakout of the benefit-cost analysis for Newton. The level of flood risk for a given structure is determined by the structure's elevation (FFE) relative to the 100-year flood level (BFE) at that site.

For example, a house whose FFE is seven feet below the BFE (FFE-BFE = -7 feet) will have seven feet of water above the first floor in a 100-year flood. Buildings with first floors above the 100-year flood level (top three rows) have the lowest probability of flooding. These structures offer the least in projected benefits.

On the other hand, the structures that would have from one to nine feet of flooding in a 100-year flood (bottom seven rows) yield the most benefits.

The benefits and costs for each group of structures at a given elevation are added together for total costs and benefits of the 39 acquired structures. The estimate of future benefits is based on probable frequencies and severities of future floods in Newton. Total project costs were roughly $750,000; total benefits were estimated at $1.6 million. With a benefit-cost ratio of 2.18, this project is considered highly cost-effective. (For more detail, see the Newton chapter in the Appendix to this report.)

Table 4. Newton Benefit-Cost Analysis Results

No. of Structures ❶	FFE-BFE (Feet) ❷	Total Sq. Feet ❸	Mitigation Costs ❹	Projected Benefits ❺			Total Benefits ❻	Benefit-Cost Ratio ❼
				Building	Contents	Displacement		
Low-to-Moderate Flood Risk								
1	3	1,235	$17,072	$2,397	$489	$454	$3,340	0.20
1	1	2,000	$12,006	$8,054	$2,283	$1,370	$11,707	0.98
4	0	5,596	$70,001	$21,562	$7,102	$4,272	$32,935	0.47
Moderate-to-High Flood Risk								
2	-1	2,400	$38,647	$11,344	$2,834	$2,257	$16,435	0.43
3	-2	6,840	$103,011	$42,830	$9,146	$7,221	$59,196	0.57
2	-4	5,037	$92,891	$22,596	$8,212	$4,569	$35,377	0.38
8	-5	9,064	$96,275	$152,504	$36,547	$30,437	$219,488	2.28
5	-6	9,481	$60,259	$314,995	$60,381	$51,531	$426,907	7.08
10	-7	16,753	$210,900	$422,549	$111,823	$74,375	$608,747	2.89
3	-9	4,000	$53,402	$155,429	$47,045	$28,820	$231,294	4.33
39		**62,406**	**$754,464**	**$1,154,260**	**$285,862**	**$205,306**	**$1,645,426**	**2.18**

❶ **No. of Structures.** Number of structures grouped by elevation (not shown). Example: three structures (fifth row) were at the same elevation.
❷ **FFE-BFE (Feet).** The difference in elevation between a structure's first floor and the base flood elevation (100-year flood). Example: the fifth row shows data for three structures, all with FFEs two feet below the 100-year flood level.
❸ **Total Sq. Feet.** Square footage of the building(s).
❹ **Mitigation Costs.** The cost to buy out the structure(s) in this elevation group.
❺ **Projected Benefits.** Damages to structures broken out by category *if they had remained in the flood zone* (i.e., had not been acquired and removed). (NOTE: "Displacement" refers to temporary rent and other related costs. For brevity's sake, "Displacement" includes lost business income.)
❻ **Total Benefits.** Total projected damages to structures *if they had remained in the flood zone* (i.e., had not been acquired and removed).
❼ **Benefit-Cost Ratio.** "Total Benefits" divided by "Mitigation Costs." A ratio of 1.0 or above means the mitigation measure is cost-effective.

BENEFIT-COST ANALYSIS: ALBANY

Following the 1994 floods, FEMA conducted benefit-cost analyses for a number of residential structures in Albany. The analyses compared the costs of acquiring and removing "at-risk" structures from the floodplain with estimated future flood damages if the buildings weren't acquired.

As with the Newton project, some of the homeowners who submitted grant applications later decided not to sell. The final group of structures acquired—and therefore the final analysis—is different from the original findings.

Flood Hazard Data

As with Newton, the first step in doing a benefit-cost analysis for Albany involves gathering flood hazard data. As you can see in Table 5, the flood hazard data for Albany came from Federal sources.

Table 5. Flood Hazard Data – Albany*

Frequency (years)	Discharge (cfs)	Elevation (feet above sea level)
10	59,300	176.7
50	86,700	181.7
100	99,100	183.6
500	130,000	189.6

*Flood hazard data from USGS and FEMA.

The data were taken from a Flood Insurance Study (conducted by FEMA and revised by an engineering company in 1995), and from the United States Geological Survey.

"As a result of the buyout program in 1994, city personnel were able to spend a greater amount of their time in March of 1998 building berms, levees, and other barriers to protect the city, and less on evacuating people from low-lying areas."

— Janice L. Jackson
Albany City Manager

Albany Analysis. . . at a Glance

- Project Cost: $2,478,476
- Benefits: $2,810,473
- Benefit-Cost Ratio: 1.13

Flood Damages & Losses Before Mitigation

Once flood hazard data are gathered, damage estimates must be made. In the Albany analysis, this includes estimated damages regarding the number, size, and replacement value of buildings, the value of their contents, and estimated costs for temporary living quarters for displaced residents. The values and sources of this information are summarized in Table 6 below.

FEMA's benefit-cost software combines these data with flood hazard data and building elevations. The result is a clear picture of how damages increase as flood depths increase.

Table 6. Data Sources – Albany Analysis

The data category...	...and its value...	...came from
Building Replacement Value (BRV)	$50	Local officials[1]
Demolition %	20%	FEMA formula
Building Size	Building type	City data
Contents Value	30% of BRV or $20,000	FEMA estimate[2]
Displacement Costs (Rent)	$0.50 (sf/month)	Local data
Displacement Costs (Other)	$0.25 (sf/month)	FEMA estimate
Displacement Costs	$200 (one time)	FEMA estimate

[1]From local officials, validated by comparison with Means Typical Cost estimates.
[2]Whichever is higher.

Analysis and Conclusions

Once all damage data are gathered and entered into the benefit-cost analysis software, a summary is generated that shows how severe future flood losses would be if the structures were to remain. That is, *if the project to remove the structures were not implemented.*

The mitigation project—acquisition and removal of the houses—completely eliminates the potential for future losses. Thus the *benefits* of the mitigation project are the damages avoided.

Table 7 below provides a detailed breakout of the benefit-cost analysis completed for Albany. The level of flood risk for a given structure is determined by the structure's elevation (FFE) relative to the 100-year flood level (BFE) at that site. Buildings with first floors above the 100-year flood level (top three rows) have the lowest probability of flooding. These structures offer the least in projected benefits.

On the other hand, the structures that would have from one to ten feet of flooding in a 100-year flood (bottom nine rows) yield the most benefits.

The benefits and costs for each group of structures at a given elevation are added together for total costs and benefits of the 105 acquired structures. Total project costs were about $2.4 million; benefits were estimated at roughly $2.8 million. The benefit-cost ratio is 1.13, which indicates that this is a relatively cost-effective project. (For more detail, see the Albany chapter in the Appendix to this report.)

The next section reveals how the mitigation projects in Newton and Albany helped both communities avoid damages in the floods of March 1998.

Table 7. Albany Benefit-Cost Analysis Results

No. of Structures ❶	FFE-BFE (Feet) ❷	Total Sq. Feet ❸	Mitigation Costs ❹	Projected Benefits ❺			Total Benefits ❻	Benefit-Cost Ratio ❼
				Building	Contents	Displacement		
Low-to-Moderate Flood Risk								
1	2	811	$19,947	$4,633	$1,301	$793	$6,727	0.34
6	1	6,637	$85,024	$24,983	$5,122	$4,397	$34,501	0.41
8	0	10,787	$174,541	$54,172	$10,127	$8,927	$73,226	0.42
Moderate-to-High Flood Risk								
17	-1	21,061	$419,672	$143,921	$29,120	$24,184	$197,225	0.47
16	-2	19,494	$562,688	$185,286	$38,723	$31,580	$255,589	0.45
25	-3	27,927	$498,919	$369,124	$78,085	$65,361	$512,570	1.03
22	-4	29,864	$492,244	$552,957	$105,679	$91,165	$749,801	1.52
2	-5	2,834	$43,918	$70,741	$11,843	$11,476	$94,060	2.14
3	-6	2,031	$50,237	$70,222	$23,616	$14,762	$108,600	2.16
1	-7	1,450	$34,025	$71,432	$12,387	$11,424	$95,243	2.80
3	-8	4,119	$81,160	$299,355	$65,367	$48,344	$413,066	5.09
1	-10	1,088	$16,101	$192,995	$44,736	$32,133	$269,865	16.76
105		**127,473**	**$2,478,476**	**$2,039,821**	**$426,106**	**$344,546**	**$2,810,473**	**1.13**

❶ **No. of Structures.** Number of structures grouped by elevation. Example: twenty-five structures (sixth row) were at the same elevation.
❷ **FFE-BFE (Feet).** The difference in elevation between a structure's first floor and the 100-year flood ("base flood"). Example: the sixth row shows data for twenty-five single story houses, all with FFEs three feet below the 100-year flood level.
❸ **Total Sq. Feet.** Square footage of the building(s).
❹ **Mitigation Costs.** The cost to buy out the structure(s) in this elevation group.
❺ **Projected Benefits.** Damages to structures broken out by category *if they had remained in the flood zone* (i.e., had not been acquired and removed). (NOTE: "Displacement" refers to temporary rent and other related costs.)
❻ **Total Benefits.** Total projected damages to structures *if they had remained in the flood zone* (i.e., had not been acquired and removed).
❼ **Benefit-Cost Ratio.** "Total Benefits" divided by "Mitigation Costs." A ratio of 1.0 or above means the mitigation measure is cost-effective.

THE MARCH '98 FLOODS

AVOIDED DAMAGES*. . .
AT A GLANCE

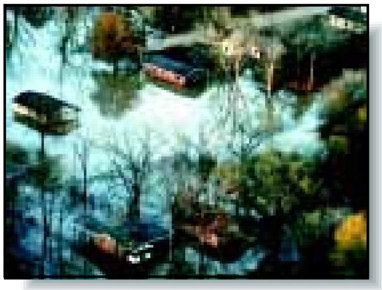
NEWTON	
• PROJECT COST:	$754,464
• AVOIDED DAMAGES:	$1,915,923
ALBANY	
• PROJECT COST:	$2,478,476
• AVOIDED DAMAGES:	$3,193,783

*FOR A SINGLE FLOOD EVENT IN MARCH 1998.

For five of the first nine days of March 1998, a storm system inundated Georgia with torrential rain. Between March 7 and March 9, the state received almost a foot of rain. More than 40 percent of Georgia's counties had some level of flooding. President Clinton declared Dougherty and five other south Georgia counties federal disaster areas, and Governor Zell Miller declared a state emergency for 72 counties.

A RECURRING NIGHTMARE

For the citizens of Albany, it was like reliving the nightmare of 1994. On March 10, the Flint River peaked at 37 feet—17 feet above flood stage. The storm flooded local drainage areas that ordinarily would have emptied into the river. Although overall flooding was less severe than in 1994, 11,000 residents were evacuated, including 3,000 students from Albany State University. Four hundred National Guardsmen were sent to the area to help with rescue operations, and the Red Cross set up emergency shelters at schools and community centers. "No one here anticipated that just three and a half years after the flood of 1994 we'd be back here," said Albany mayor Tommy Coleman.


Source: FEMA

Flooding in Albany, March 1998.

"IN THE 1998 FLOOD, NOT ONE OF THE NEW LOCATIONS WAS FLOODED. THE BUYOUT. . .HAS BEEN VERY EFFECTIVE. THESE SAME PEOPLE WOULD HAVE BEEN FLOODED IN 1998 HAD THEY REMAINED."

— TOMMY COLEMAN
MAYOR OF ALBANY

In Newton, the story was much the same. On Friday March 12, the Flint River at Albany receded slightly in the afternoon as floodwaters pressed downstream toward Baker County. In some areas of Newton, floodwaters rose as high as nine feet.

FEDERAL RELIEF EFFORTS

The Clinton administration was quick to offer federal disaster relief to the besieged residents. James L. Witt, Director of the Federal Emergency Management Agency, flew over the flood area to survey the damage, and recommended that the president declare half a dozen counties eligible for disaster relief.

HAZARD MITIGATION PUT TO THE TEST

Although thousands were evacuated from their homes in March 1998, the mitigation measures put in place after the 1994 flood paid off. The advantage of acquisition projects is that the risk of future flood damage is completely eliminated. By removing many at-risk structures in the floodplain, both Newton and Albany avoided millions of dollars in damages that would have occurred if those buildings had remained.

AVOIDED DAMAGES: NEWTON

The buyout of 39 residential and business properties after the 1994 flood proved to be an effective investment in Newton. FEMA's benefit-cost analysis software determined that for an upfront cost of approximately $750,000 to acquire flood-prone properties, nearly $2 million in damages and losses were avoided. If these buildings had merely been repaired after the 1994 flood, many would have been completely destroyed in 1998.

The figures for avoided damages in 1998 apply to those structures that were deep enough in the floodplain (first-floor elevations of less than 147 feet) to have been flooded had they remained in the flood-risk zone. Structures higher in the floodplain (elevations of more than 147 feet) wouldn't have been flooded in 1998 and so wouldn't have suffered damages.

This illustration of avoided damages emphasizes a very important point for hazard mitigation planning: the biggest benefits come from acquiring structures at highest risk—that is, buildings that are deepest in the floodplain.

Table 8. City of Newton
Mitigation Project Avoided Damages – March '98 Flood

No. of Structures	First Floor Elevation	1998 Flood Above FFE	Avoided Damages			Total Avoided Damages
			Building	Contents	Disp.[1]	
3	142.4	4	$202,050	$43,777	$37,611	$283,438
10	144.4	2	$664,785	$126,730	$115,229	$906,744
5	145.4	1	$521,455	$54,743	$81,121	$657,319
8	146.4	0	$40,003	$26,066	$2,353	$68,422
13	147 to 154	-1 to -8	$0	$0	$0	$0
39			**$1,428,293**	**$251,316**	**$236,314**	**$1,915,923**

[1]Displacement due to temporary rent and other related costs; includes estimated lost business income.

AVOIDED DAMAGES: ALBANY

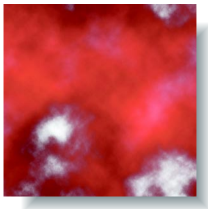
As with the Newton buyout, the removal of at-risk houses in Albany helped the city avoid significant losses in the March 1998 flood. For a total cost of $2.4 million to acquire the properties, over $3 million in damages were avoided in the very first flood after the project was carried out. Again, it's clear that the houses that had been deepest in the floodplain would have suffered the greatest damages if they hadn't been acquired and removed.

These results make a compelling case that hazard mitigation isn't just a good idea on paper—but that it has measurable benefits after a real disaster.

Table 9. City of Albany
Mitigation Project Avoided Damages – March '98 Flood

No. of Structures	First Floor Elevation	1998 Flood Above FFE	Avoided Damages			Total Avoided Damages
			Building	Contents	Disp.[1]	
1	173.6	8	$54,400	$13,200	$9,860	$77,460
3	175.6	6	$205,950	$46,419	$34,782	$287,151
1	176.6	5	$72,500	$9,788	$12,063	$94,350
3	177.6	4	$101,550	$26,100	$22,080	$149,730
2	178.6	3	$141,700	$17,217	$23,724	$182,641
22	179.6	2	$1,493,200	$172,471	$252,989	$1,918,661
25	180.6	1	$191,079	$110,728	$46,124	$347,930
16	181.6	0	$87,723	$48,136	$0	$135,859
32	182 to 185	-1 to -4	$0	$0	$0	$0
105			**$2,348,102**	**$444,059**	**$401,622**	**$3,193,783**

[1]Displacement due to temporary rent and other related costs.



CONCLUSION

Natural disasters are a fact of life. Unfortunately, it's hard to envision a world where disasters don't bring some degree of suffering. But while disasters can't be avoided altogether, the damage they cause can be reduced.

That's why FEMA's Hazard Mitigation Grant Program was created. With foresight and proactive planning, people who live in disaster-prone communities now have the means to do something about natural disasters.

Hazard Mitigation. . . Why it Works

Hazard mitigation projects make sense when the damages avoided are higher than the costs of the measure. Such projects *cost-effectively* reduce or eliminate the damages, losses, and hardship of repeated flooding.

The grant program has existed for only a few years. But in an effort to make it as efficient as possible, it's important to evaluate the program to see how well it's working. This is one of the first times since the inception of the program that FEMA has revisited several communities to quantify actual dollars saved due to hazard mitigation.

This economic analysis of flood mitigation projects in southwest Georgia reviewed both the original estimates of how much could be saved in avoided future damages in two Georgia communities—as well as the supporting data to show just how much was actually saved in a single, real-world flood event.

The results are impressive. In the very first flood since the FEMA-funded acquisition and removal of at-risk structures, the small community of Newton realized $1.9 million in avoided damages. The city of Albany saved even more: $3 million in avoided damages.

> By making mitigation a part of long-term recovery, communities will be safer, more economically viable, and more disaster-resistant than they were before.
>
> — President's Long-Term Recovery Action Plan Georgia, March 1998

The Bottom Line

This report has shown that hazard mitigation can be a cost-effective way to help reduce the toll of future disasters. And while it may not be a panacea, it's a big step in the right direction.

Newton and Albany, Georgia are two communities that have taken that first step. Although they'll undoubtedly suffer through flooding in the future, they have begun to make themselves more disaster-resistant. Both cities will continue to reap benefits from their mitigation projects for years to come. And that doesn't just save money. It also improves the quality of life for people who know these places not as "flood-prone" communities, but as home.

- For more information about the Hazard Mitigation Grant Program, contact your State emergency management agency.
- To learn more about hazard mitigation,isit FEMA's web site at http://www.fema.gov.
- For an in-depth review of the analysis presented here, see the Appendix to this report.